Exhibit "E" Revised

Scope Documents

- Technical and General Bid Requirements
- Storage Building Floor Plan
- Storage Building Roof Framing Plan
- Storage Building Roof Plan
- Storage Building Structural Detail
- Storage Building Wall Section
- Panel Board Schedules

The Following Items Were Inadvertently Omitted From the Original Exhibit "E"

- Solar Array Layout
- Second Floor Plan Power
- Electrical Riser and Enlarged Plans

KNOXVILLE TRANSIT CENTER TECHNICAL AND GENERAL BID REQUIREMENTS March 3, 2009 Specification

The following specifications help to ensure the bidders turn in all relevant documents and are aware of expectations should they be awarded the contract. The term "Contractor" refers to those submitting a proposal. The term "Owner" refers to the Public Building Authority, Knox County & Knoxville, Tennessee.

1. General Information

- 1.1. These specifications cover the procurement of equipment, hardware, documentation, labor and supervision required for the installation of a grid-connected PV system and associated structures as part of the Knoxville Station Transit Center Photovoltaic (PV) project. The site address is 301 E. Church Avenue, Knoxville, TN 37902, with site completion expected in August 2010, or as required by the construction schedule.
- 1.2. The system shall be composed of a PV array of approximately 5 kW peak DC capacity, installed upon a roof-mounted sloped structure on the storage building, as shown in the attached drawings. This bid includes construction of this roof-mounted structure and installation of all required PV array components.
- 1.3. The system shall be provided on a "turn-key" basis to the Owner. The bidder shall provide energy production estimates with documentation supporting the calculations. There will be no energy storage devices (e.g. batteries) used in these systems.
- 1.4. Bids must list all major system components required to complete system installations. In addition, documentation on the design, configuration, installation, operation, and maintenance of the complete system must be included.
- 1.5. All systems should be designed for outdoor installation in Knoxville. The area is subject to long-term high humidity and temperature conditions. The system shall be designed to handle expected ambient temperatures that range from -10° F to 110° F. Supplied equipment must be rated and warranted to withstand and operate under these conditions.
- 1.6. These PV system and its associated structures shall be certified by a Tennessee-registered Professional Engineer to meet the local wind loading requirements.
- 1.7. System complexity adds to the labor and material costs of installing a system. The Owner will consider this factor in evaluating bids.
- 1.8. Each PV system will be interconnected to the Owner's utility connection through a grid-interactive inverter(s). The design and specification of the PV modules, power conditioners, utility interconnections, PV system electrical design, and PV array mechanical design are described in the following sections.
- 1.9. Contractors should be aware of all the documentation and procedural issues required prior to submitting bid. These are listed below.

- 1.10. The successful Contractor shall be a state-licensed General Contractor or Electrical Contractor.
- 1.11. The successful Contractor should provide documentation of experience in the installation of similarly-sized systems.
- 1.12. Owner will incorporate required manufacturer's and vendor's drawings into its as-built drawings for its own records. Therefore, all drawings submitted for bid evaluation shall be provided within three (3) weeks after the award. Drawings will be submitted in an electronic format that may be imported into AutoCAD drafting software. Proper credit of the source of these drawings will be noted on the Owner's drawings.
- 1.13. Contractor shall be responsible for educating, coordinating, and satisfying all questions from the Utility before, during, and after installation.
- 1.14. Supplier may include any value-added services in their quotations, as long as they are not bound to the mandatory portions of this specification.
 - 1.14.1. The Contractor will provide an option for an Extended Service Contract, thereby extending labor, technical assistance and routine maintenance. Routine maintenance is defined as the act of making sure the PV system operates properly, with annual checkups at a minimum. This includes changing blown fuses, diodes, or other minor equipment. This does not extend the warranties of factory-warranted components such as the modules or inverters, but includes any labor required to change out these or other components that fail during the Extended Service Contract. Bids shall include pricing for Extended Service Contracts of 5, 10, and 15 years.

2. PV MODULE AND ARRAY SPECIFICATIONS

- 2.1. The PV modules shall be bifacial Sanyo HIT Double modules, Model HIP-200DA3 or approved equal. The array shall be composed of 24 of these modules, arrayed in a landscape orientation, as shown in the accompanying architectural sketch.
- 2.2. If alternate modules are used, they shall meet or exceed the appropriate UL/IEEE/IEC standards.
- 2.3. Each PV module shall be warranted by the manufacturer for at least 80% of its rated power for 20 years from the date of system acceptance.

3. OTHER COMPONENT SPECIFICATIONS

- 3.1 The inverter must be compatible with connection to 277v service. An SMA America Sunny Boy 5000US or approved equivalent is recommended. Inverter(s) shall be designed specifically for utility grid interconnection of photovoltaic arrays and be capable of automatic, continuous, and stable operation over the range of voltages, currents, and power levels for the size and type of array used.
- 3.2 Each inverter shall be compliant with the most recent revisions of UL standard 1741 and IEEE standards 1547 and 1547.1. The inverter shall also comply with IEEE Std. 519 (Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems) and the latest applicable ANSI

- and FCC standards and addenda dated prior to the award of the purchase order for this procurement.
- 3.3 The inverter(s) must have an automatic visual indicator showing whether the system is on-line and operating properly.
- 3.4 The inverter(s) must have at least a ten-year repair or replacement warranty from the manufacturer covering parts and labor.
- 3.5 The inverter shall be installed within the maintenance building beneath the PV system. AC and DC disconnects and any other required electronics shall be installed near the array, where they may be exposed to weather and possible vandalism. All electrical enclosures shall be in the shade during peak sun hours (or installed indoors if space is available) to enhance system reliability. All electrical enclosures shall be of the appropriate NEMA rating.
- 3.6 The contractor shall include in the bid, as a separate line item, a data monitoring system with a display accessible via the internet. As many options are available for these systems (e.g. Fat Spaniel, SMA SunnyPortal, etc.), several system options may be offered with the bid. The Contractor is responsible for the communications wiring between the data monitoring system and the building's internet connection. Product details of the proposed data monitoring system shall be included with the bid package.

4. PV SYSTEM ELECTRICAL DESIGN

- 4.1. The electrical design and installation instructions for the PV systems shall conform to the 2005 National Electric Code (NFPA 70). Article 690 of the NEC applies specifically to photovoltaic system safety, protection, control and interface with other sources. Other articles of the NEC also apply.
- 4.2. All electrical components, including overcurrent protection, disconnect, surge suppression devices, conduit, wiring and terminals must have UL or equivalent listing and have appropriate voltage, current and temperature ratings for the application. Special attention should be given to appropriate ratings for components used in DC circuits.
- 4.3. All wiring shall be listed for a minimum operation of 600 volts and temperature rating of 90°C in wet locations. Wiring and conduit shall be sunlight-resistant where required.
- 4.4. Ampacity calculations must take into account appropriate de-ratings as required. All conductors in the system are subject to a 125% NEC de-rate, and all DC source circuit conductors and overcurrent devices must include an additional 125% de-rate for solar radiation enhancement. Appropriate temperature de-ratings for conductors used in module junction boxes must be considered for peak module operating temperatures, as well as de-ratings for instances where more than three current-carrying conductors are enclosed in a conduit. Electrical enclosures (including the inverter) shall be shaded from direct sunlight wherever possible.
- 4.5. Total voltage drop in the system (including DC and AC) shall be no more than three percent (3%), including losses in conductors and through all fuses, blocking diodes, and termination points.

- 4.6. Interconnection shall be made via a load-side connection per NEC 690.64(B), connecting to the electrical distribution system as allowed by the site electrical designer.
- 4.7. All overcurrent devices shall have trip ratings no greater than the de-rated ampacity of the conductors being protected.
- 4.8. Each series-connected string of modules (also known as source circuits) shall include a series fuse as required by UL and NEC to prevent damage to wiring or other system components. Parallel connections of modules within individual source circuits are not permitted.
- 4.9. The inverters shall include array ground-fault protection devices, which must be capable of detecting array ground faults, shunting the fault current to ground, and disabling the array until the fault has been cleared.
- 4.10. All terminations must be listed multi-contact, box terminal, or compression type connections. Twist on wire splices, crimped, soldered or taped connections are not permitted for the required field installed wiring. Proper torque specifications should be provided for all of the required field connections.
- 4.11. All module frames, panel/array support structures, metal enclosures, panel boards and the inverter cabinet(s) should be provided with connections for bonding to a common equipment grounding conductor, terminating at the utility service ground. Modules shall be grounded with tin-plated copper lay-in lugs rated for outdoor use (typically labeled as suitable for direct burial).
- 4.12. In addition, provisions for grounding the neutral of the inverter output shall be provided. The DC ground conductor may be common to the AC neutral in the inverter design and under no circumstances should multiple connections to ground be specified for current-carrying conductors in the system.
- 4.13. Appropriate surge suppression devices should be installed on both the DC and AC sides of the system.
- 4.14. The Contractor shall coordinate interconnection details with the Utility, and shall be responsible for the required interconnection paperwork with input from the Owner. The Owner will provide and install the wiring and conduit from the interconnection point through the two Utility-accessible external AC disconnects. This includes the electrical meter base that will measure the system's production. The meter itself will be installed by TVA/KUB, under the supervision and coordination of the Contractor.
- 4.15. Loss of Line: The inverter(s) shall not operate without the line voltage present. The inverter(s) restart shall occur automatically after restoration of line voltage and frequency for at least five minutes.

5. PV ARRAY MECHANICAL DESIGN

- 5.1. The Contractor shall provide the mechanical hardware for mounting the photovoltaic arrays. The Contractor shall provide all other hardware required for assembling the photovoltaic modules and panels and structurally attaching them to the roof supports. (Refer to the attached drawings showing the attachment points.)
- 5.2. The PV array, including modules, hardware and attachments shall be designed to withstand the required wind loads and comply with all existing

- local and national codes. Verifying documentation shall be provided to the Owner.
- 5.3. Array mounting hardware supplied by the bidder should be compatible with the site considerations and environment. Construction will be in accordance with the design drawings supplied in conjunction with the original bid package and will meet workmanship standards that ensure a high-quality appearance under both close and distant inspection. Special attention should be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structure. Corrosion resistance and durability of the mechanical hardware should be emphasized the use of stainless steel fasteners and an aluminum support structure is preferred. Galvanic corrosion should be avoided.
- 5.4. As these are high profile, publicly visible installations, the aesthetics of the overall installation is extremely important to the Owner. To create a uniform appearance of the array, spacing between individual modules and panels should be kept to a minimum. As much as possible, all mechanical hardware, conduit, junction boxes and other equipment should be concealed.
- 5.5. The array layout should be consistent with the ordering (and labeling) of source circuits in the array combiner boxes. Ease of access for array troubleshooting and maintenance is desired by allowing access to the back of the array for module junction box servicing (as required), and removal/replacement of individual source circuits and modules if necessary.
- 5.6. It is desired that the modules have at least three (3) to five (5) inches of space beneath to allow array ventilation. This prevents excessive temperatures that decrease output and increase module degradation.

6. INFORMATION TO BE SUPPLIED WITH BID

- 6.1. Bid documents must include (at a minimum) the following information for the bid to be considered responsive:
 - 6.1.1. The bid shall include the total bid price.
 - 6.1.2. The bid shall include the required lead-time in delivery of equipment.
 - 6.1.3. The bid shall include the required documentation package.
 - 6.1.4. A price list for all replacement components, including individual modules and the inverters shall be included. These prices are to remain in effect for one year after the date of acceptance.
 - 6.1.5. Parts lists, including all major electrical components, mechanical hardware and other equipment required for installing the systems (must include description and make for all the equipment provided, model/part number and source are also required for the PV modules and the inverter).
 - 6.1.6. Diagram indicating proposed layout of entire system, including PV array, and location of BOS hardware and inverters with respect to the array.
 - 6.1.7. Information showing details of module/array mechanical support, including structural drawings and component photographs sufficient to enable the aesthetic compatibility of the proposed structure to be evaluated by the architectural design team.

- 6.1.8. Warranty information on individual components as required in this bid document.
- 6.1.9. Proof of contractor's license, with license number, type of license and expiration date, and proof of NABCEP Certification or proof that the contractor will be taking the certification test in March, 2009.
- 6.1.10. All manufacturers' equipment specifications, including those for PV modules, inverter, overcurrent devices, disconnects and optional equipment.
- 6.1.11. An acceptance test plan describing the methods and equipment that will be used to ensure that the system and subcomponents are all functioning within the manufacturers' rated performance specifications. Test plan details will include definition of acceptable results for each test condition.
- 6.1.12. Safety records of the firm.
- 6.1.13. Certification of intent to conform to the Davis-Bacon prevailing wage rates.
- 6.1.14. Certification of intent to conform to all applicable regulations such as Workman's Compensation, drug-free workplace, non-discrimination, etc..
- 6.2. Designs will be reviewed as part of the bid review process. The drawings and other technical information will be checked for completeness, accuracy, and aesthetic compatibility of the structure. Bidders with insufficient design information may be requested for additional supporting material or have their bid dismissed outright.

7. INFORMATION TO BE PROVIDED BY CONTRACT AWARDEE BEFORE PROJECT COMPLETION

- 7.1. The Contractor is responsible for providing two complete copies of all installation, operations and maintenance manuals.
- 7.2. The Contractor will provide design, materials, installation, and permitting price information. The materials information will be broken down into three categories: modules, inverter(s), and other. These costs should be the costs to the Owner, and not wholesale or distributor costs, and should be similar or identical to those on the parts list mentioned above (Section 6.1.5). In the case of packaged PV systems, the materials cost breakdown may not be possible, so the replacement cost of each component should be listed, along with the cost of any miscellaneous materials (e.g. wire, junction boxes, etc.).
- 7.3. As-built diagrams indicating overall layout of entire system, including PV array, and location of BOS hardware and inverter with respect to the array.
- 7.4. A site survey of the intended array location should be completed before the installation begins. This will help the Contractor determine appropriate equipment locations and give all parties a better idea of the expected performance of the PV system.
- 7.5. The PV system design must be approved by design review team.
- 7.6. A copy of the interconnection agreement between the Owner and Utility must be provided by the Contractor to the Owner.
- 7.7. An acceptance test must be performed on the system once the installation is complete, with assistance from DOE/ORNL/FSEC personnel. This includes measuring the short circuit currents and open-circuit voltages on all source

- circuits while measuring irradiance and module temperature. This also includes measuring the instantaneous DC input and AC output of the system to determine its efficiency. These tests will be conducted in accordance with the test plan submitted as part of the original bid package.
- 7.8. A copy of the permit obtained from the appropriate legal authority for system installation.
- 7.9. A copy of the **minimum one-year** system warranty including parts and labor as well as individual subsystem component warranties.
- 7.10. Array structural design information sealed by a professional engineer is required.
- 7.11. The processing of paperwork for the technical information required by the TVA/KUB that may be required for the Owner to participate in any green power production programs.

8. PROJECT SCHEDULE

8.1. The site will be ready for PV system construction to begin in approximately March, 2010, as directed by the Construction Manager. The Contractor will have 30 business days to complete construction of the PV system.

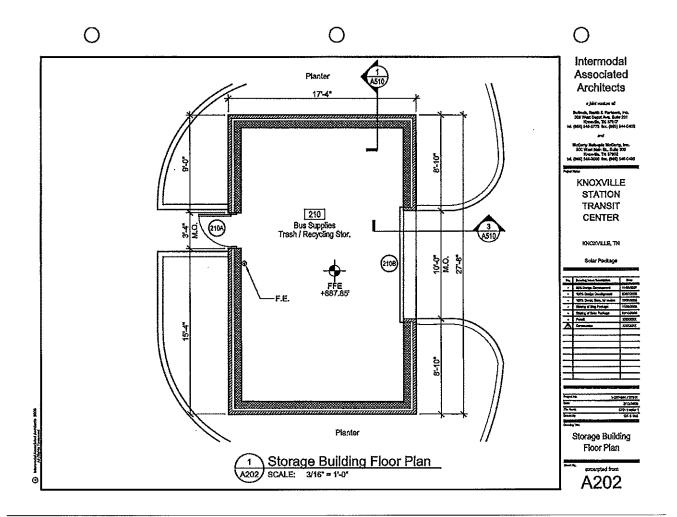
9. BONDS

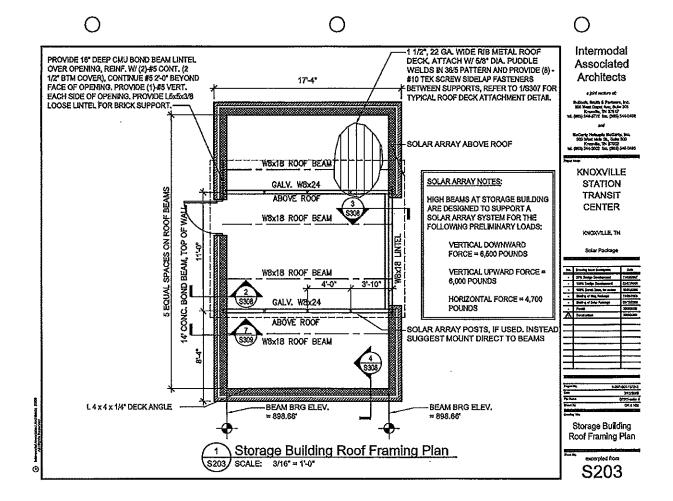
9.1. The Contractor will be required to submit evidence that they can provide a Performance and Payment Bond in the full amount of this contract.

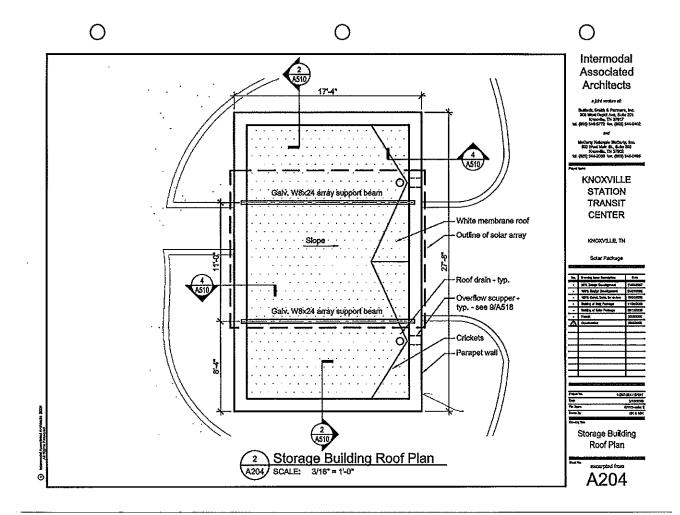
SUMMARY:

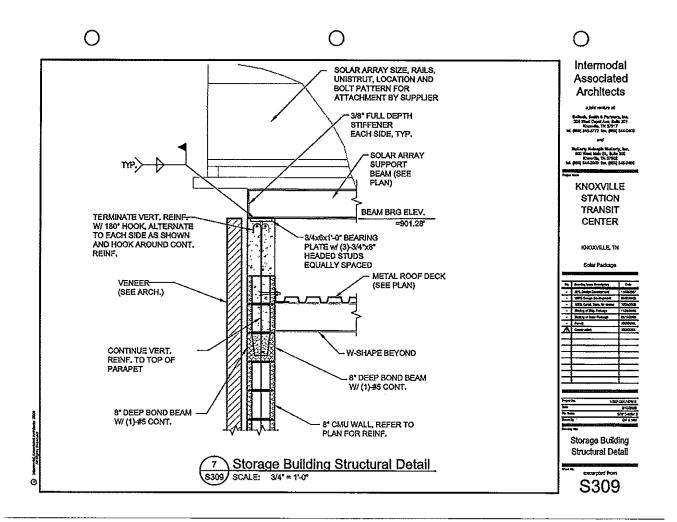
In your bid response, please provide line item costs for:

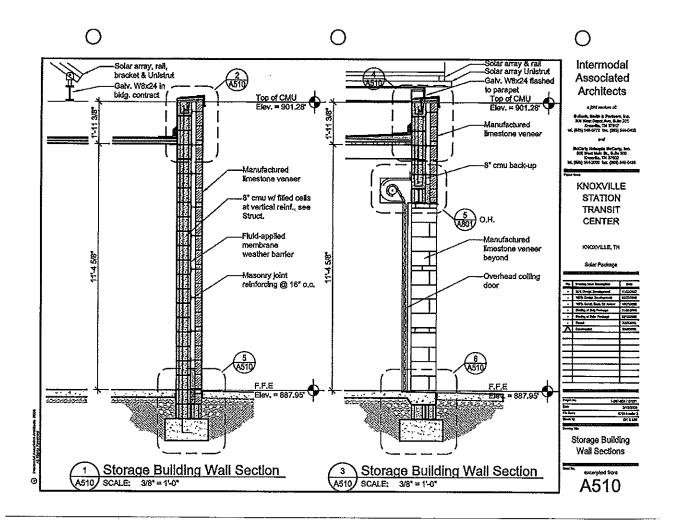
- 1. PV Array + BOS materials
- 2. PV Labor
- 3. Internet-accessible data monitoring system
- 4. Extended Service Contract (per Section 1.15.1—please provide details of the services provided in this extended contract), for 5, 10, and 15 year periods
- 5. Bond

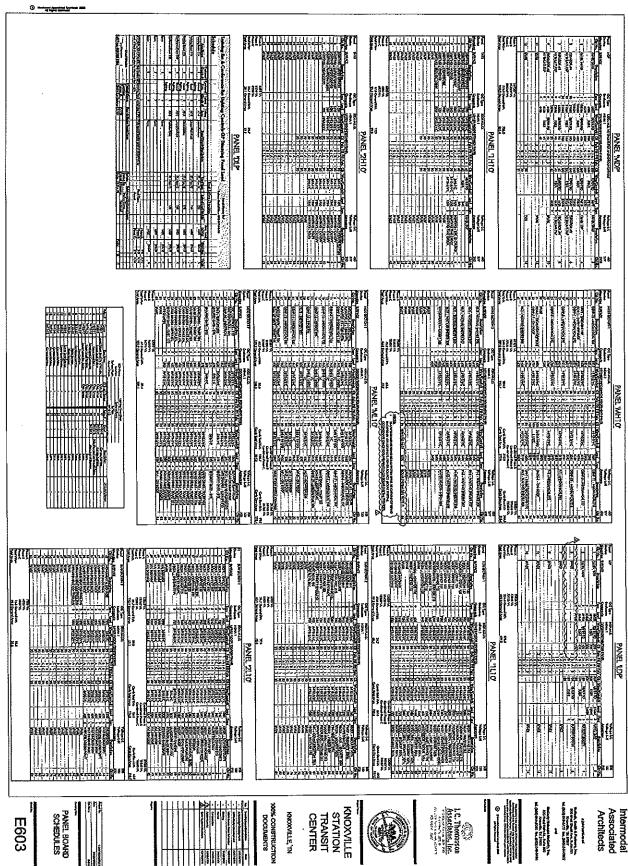












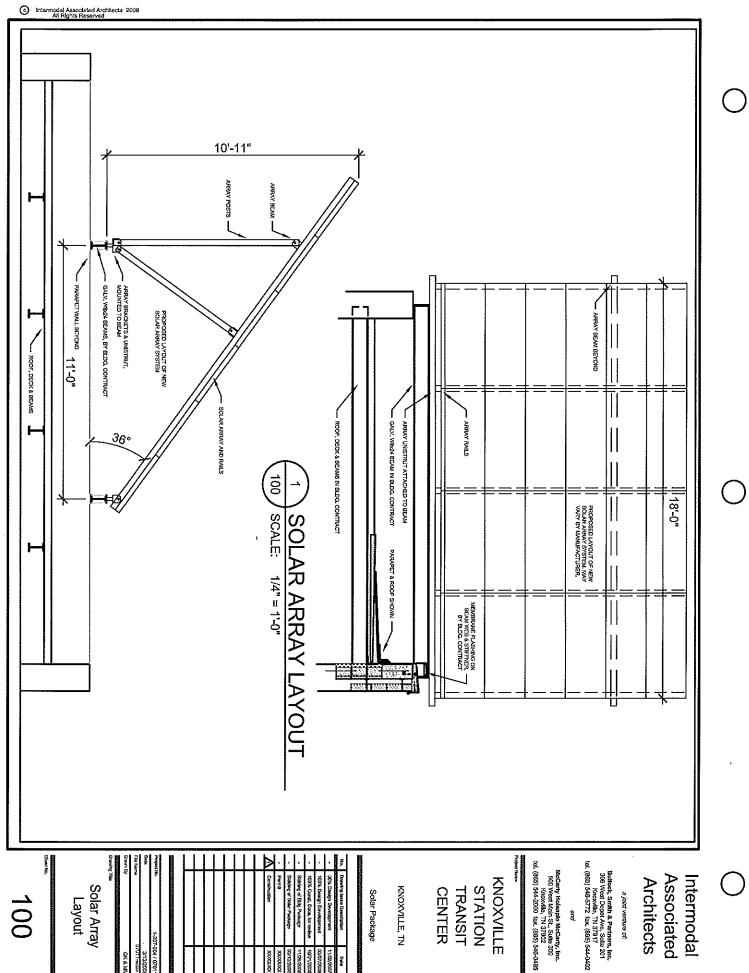
100% CONSTRUCTION DOCUMENTS

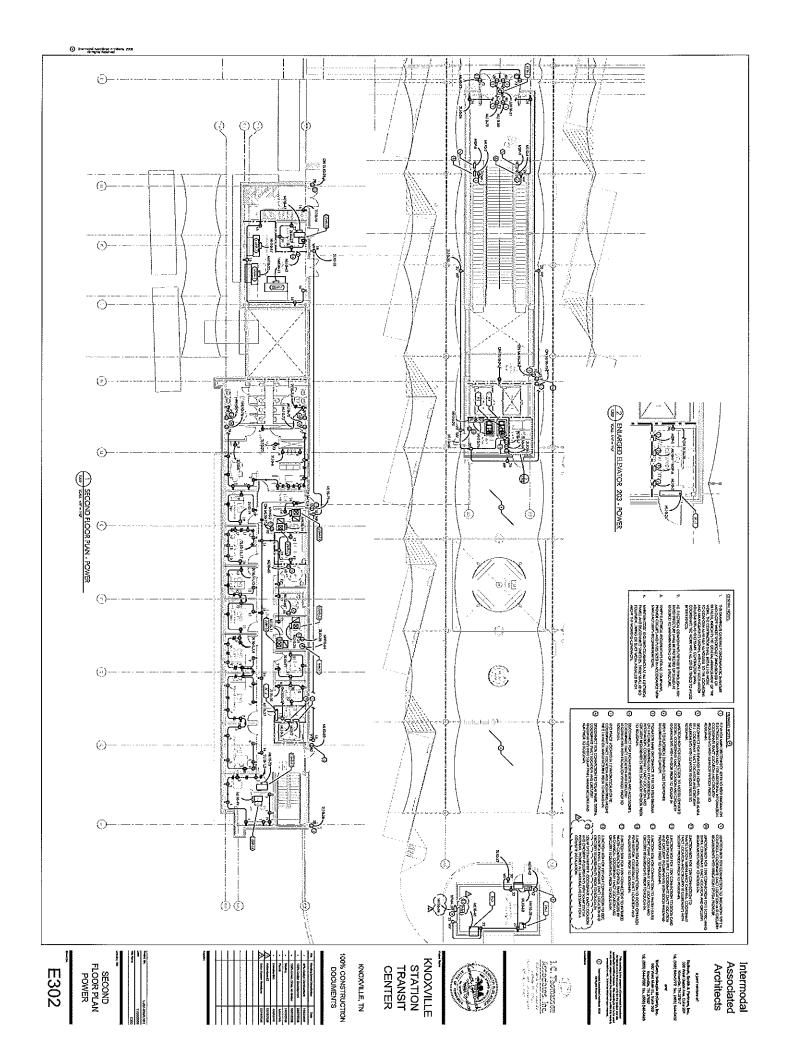






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ELECTRICAL RISER AND ENLARGED PLANS

100% CONSTRUCTION DOCUMENTS

KNOXVILLE, TN

KNOXVILLE STATION CENTER TRANSIT







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District, Braining in American Co.

200 WARD Display and State Co.

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